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④ Apparatus for measuring cardiac output.

EP 0 378 234 A1 ⑤ An apparatus for measuring cardiac output includes a reference temperature sensing element (8); a temperature measurement circuit (15) for obtaining a reference temperature signal from a temperature detected by the reference temperature sensing element; a first temporary storage memory (41) for storing the detected reference temperature; a thermometry temperature sensing element (10); a second memory for obtaining a thermometry temperature signal with the temperature measurement circuit from a thermometry temperature detected by the thermometry temperature sensing element and for storing the obtained thermometry temperature signal; a correction value calculation circuit (42) for maintaining a correction value obtained on the basis of the reference temperature signal stored in the first memory and the thermometry temperature signal stored in the second memory; and a temperature calculation circuit for calculating a corrected tem-

perature value based on a thermometry temperature signal newly produced during measurement and the maintained correction value.

APPARATUS FOR MEASURING CARDIAC OUTPUT

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates generally to information measuring apparatus and, more particularly, to an apparatus for measuring cardiac output during and after an operation for a cardiac function test, heart surgery or the like.

Description of the Related Art

The applicant of the present invention has disclosed an apparatus for measuring cardiac output in Japanese Patent Laid-Open No.61-125329. This apparatus has a pair of temperature sensing elements provided in a catheter type sensor probe and operates as described below. The first temperature sensing element is used to detect the temperature of blood to obtain the cardiac output based on a thermodilution method, while the second temperature sensing element is heated up and the temperature thereof is measured to obtain the blood stream velocity. The sectional area of the blood vessel is obtained from the cardiac output based on the thermodilution method and the blood velocity, and the blood velocity is thereafter continuously obtained based on the this method with the term of the blood vessel sectional area used as a correction value.

To manufacture temperature sensing elements used in this apparatus, it is necessary to examine the characteristics of thermistors, i.e., the temperature sensing elements. All the temperature sensing elements are therefore placed in a constant temperature bath exposed to an atmosphere of a constant temperature, and the relationship between temperatures and output characteristic values of each temperature sensing element output under this condition is obtained in comparison with a reference thermometer.

On the basis of each of the relationships thereby determined, good articles and inferior articles of the temperature sensing elements are separated from each other, and a probe circuit or the like to be connected to each temperature sensing element is formed to effect compensation for the characteristic values of the temperature, thereby enabling each temperature sensing element to be used for temperature measurement.

Temperature sensing elements for use in measuring apparatus based on the conventional th-

modilution method and the conventional thermal type flow measurement method are manufactured in this manner. An additional manufacture step is therefore required along with troublesome management of records of measured characteristic values of respective temperature sensing elements. The problem of reduction in the yield is also encountered.

Moreover, the probe circuit provided as a means for compensating for the characteristic values of the temperature sensing element also entail the problem of variations in its characteristic values and the problem of the characteristic values being changed after it has been connected to the temperature sensing element, resulting in occurrence of measurement errors.

In a case where the temperature is measured by the thermal type flow measurement method apart from the measurement based on the thermodilution method, the characteristics of the temperature sensing element may be influenced by heat during heating of the periphery of the temperature sensing element, resulting in a deterioration in the measurement accuracy.

SUMMARY OF THE INVENTION

The present invention has been achieved in consideration of the above-described problems, and an object of the present invention is to provide an apparatus for measuring cardiac output designed to eliminate the unnecessary step of examining temperature sensing elements used in the apparatus in the process of manufacturing the temperature sensing elements.

Another object of the present invention is to eliminate the need for a probe circuit or the like which is a means for compensating for the characteristic values of a temperature sensing element and to thereby avoid measurement errors.

Still another object of the present invention is to prevent a temperature sensing element from being influenced by heat during heating of the periphery of temperature sensing element based on the thermal type flow measurement method used along with the thermodilution method.

To achieve these objects, according to the present invention, there is provided an apparatus for measuring temperatures relating to an organism by using a probe having at least two temperature sensing elements, the apparatus comprising: a reference temperature sensing element; a temperature measurement circuit means for obtaining a